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(54) **Production of electroplated  
goods free from whiskers**

(57) Process for the production of  
electroplated goods, in particular  
electroplated wires, substantially  
free from whiskers, characterised in  
that the electroplated goods are  
subjected to subsequent heat  
treatment, during which they are

heated to a temperature just below  
the melting point of the tin applied by  
electroplating or below the eutectic  
temperature of the tin alloy applied.

The plated goods are preferably  
heated to a temperature from 5°C to  
30°C below the melting point of tin or  
below the eutectic temperature.

Heating preferably carried out in an  
inert gas.

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## SPECIFICATION

### Process for the production of electroplated goods substantially free from whiskers

The invention relates to a process for the production of electroplated goods, in particular electroplated wires, substantially free from whiskers.

The problem of the formation of whiskers exists in tinning, especially of wires or conductor tracks. These whiskers, which consist of filamentous monocrystals, grow on tin, for example on tinned wires or conductor tracks, and can lead to various troubles, such as, for example short circuits in conductor tracks, by growing from one conductor track to another and bridging them. This whisker formation is caused by the tension in the layer of tin or tin alloy applied. If this tension decreases in the course of time through ageing, whiskers are formed as a result of the energy released.

Various measures for avoiding such adverse formation of whiskers are already known. For example, if the tin is melted, less whisker formation occurs. Although layers of tin obtained by hot tinning or by melting layers of tin applied by electroplating have the advantage of a lower tendency to form whiskers, they have the disadvantage that, especially in the case of wires, the layer of tin applied is asymmetric to the core to be tinned. This asymmetry or non-uniformity of the layer of tin applied has the disadvantage that they do not have the minimum coating thicknesses specified by the relevant standards over the cross-section mentioned, which means that difficulties may occur during soldering. As a result of diffusion of atoms from the core consisting of, for example, copper into the tin layer applied and vice versa, a copper/tin phase forms. However, if, because of the non-uniformity mentioned, the layer of tin is so thin that it is completely occupied by the copper/tin phase, no further wetting with tin in the context of a subsequent processing operation can be achieved. Such a processing operation can be, for example, soldering of a component into a printed circuit board or soldering of a wire onto a component, such as, for example, in the production of capacitors, contamination of the electrode occurring in the latter case.

The invention is therefore based on the object of providing a process for the production of electroplated goods, in particular electroplated wires, substantially free from whiskers, the invention being characterised in that the electroplated goods are subjected to subsequent heat treatment, during which they are heated to a temperature just below the melting point of the tin applied by electroplating or just below the eutectic temperature of the tin alloy applied. The advantage of a tin layer of uniform thickness produced by electroplating and its substantially whisker-free formation can thereby be achieved. This reliably ensures that the layer of tin is wettable at all points and hence any subsequent

processing operations can be carried out without problems.

The abovementioned mechanical tension is released by heating the material to be tinned to a high temperature, and the formation of whiskers is therefore stopped in a relatively simple and reliable manner. It is of no importance here whether the layer of tin applied by electroplating consists of pure tin or of a tin alloy, such as, for example, a tin/lead alloy. It is advantageous, especially in the case of tin/lead alloys with a high lead content, to carry out the heating according to the invention under an inert gas.

According to another advantageous embodiment of the process, the tinned goods can be heated to about 5° to about 30°C below the melting point of tin or to just below the eutectic temperature of the alloy.

In the heat treatment, according to the invention, of wires, it has proved particularly advantageous if the wire or wires passes or pass continuously through a heat treatment zone. The best results have been achieved with a heating oven, but heating can also be effected inductively by infrared treatment or the like. The wire heat-treated in this manner is then advantageously subjected to enforced cooling, that is to say it passes through a cooling zone, which can be realised in the most diverse manners which are known per se.

Preferably, with tinned piece goods, these can most advantageously be introduced as such into a heating oven for the purpose of the heat treatment according to the invention. When the heat treatment has been carried out, the piece goods are preferably left to cool at room temperature.

## Claims

1. Process for the production of electroplated goods, in particular electroplated wires, substantially free from whiskers, characterised in that the electroplated goods are subjected to subsequent heat treatment, during which they are warmed to a temperature must below the melting point of the tin applied by electroplating or below the eutectic temperature of the tin alloy applied.

2. Process according to claim 1, characterised in that the tinned goods are heated to a temperature which is up to 5°C to about 30°C below the melting point of tin or below the eutectic temperature.

3. Process according to claim 1 or 2, characterised in that the heating is carried out under an inert gas.

4. Process according to claim 1, 2 or 3, characterised in that the electroplated goods are subjected to the subsequent heat treatment by continuously passing through a heat treatment zone, for example in a heating oven.

5. Process according to claim 4, characterised in that the electroplated goods are subjected to enforced cooling after the subsequent heat treatment.

6. Process according to claim 1, 2 or 3, characterised in that the electrotinned goods are subjected to the subsequent heat treatment by introduction as piece goods into a heating oven.

5 7. Process according to claim 6, characterised in that the tinned goods are brought out of the oven when the heat treatment has ended and are exposed to room temperature.

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